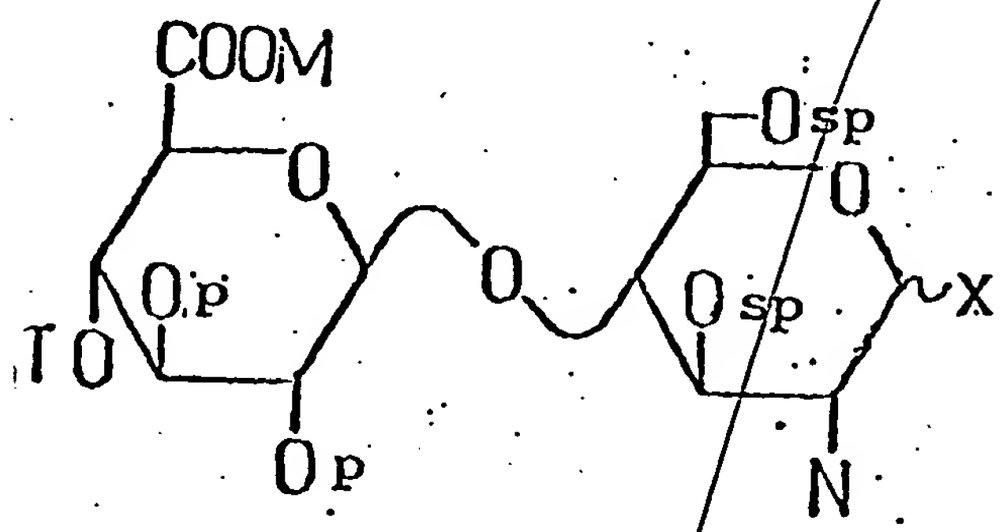
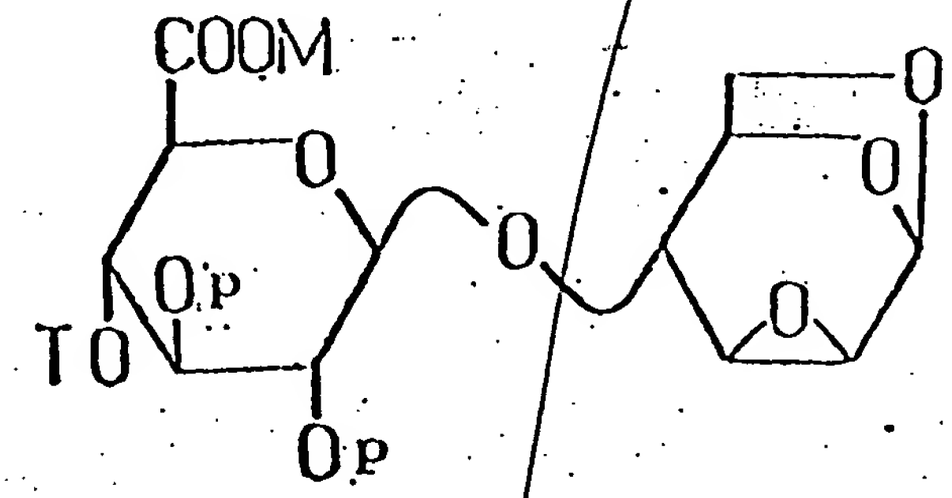
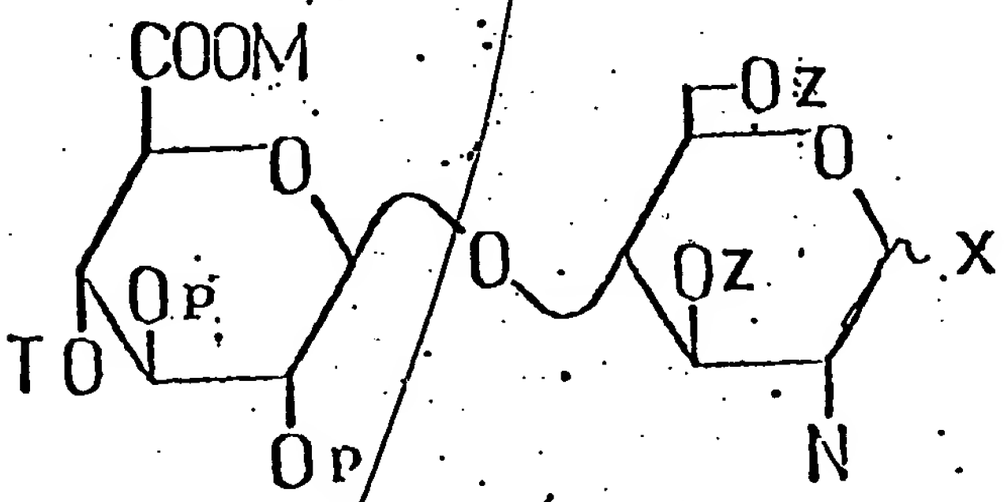
--89. A synthetic pure compound of the formula selected from the group consisting of



(II)



(III)



(IV)

wherein

T is acyl from 1 to 8 carbons, halogenated acyl from 1 to 8 carbons, phenyl substituted alkyl from 7 to 19 carbons, O-sulfate ester, O-phosphate ester or hydrogen,

X is O-acyl from 1 to 8 carbons, O-alkyl from 1 to 3 carbons, O-phenyl substituted alkyl from 7 to 19 carbons, halogen or imidoyl,

p is phenyl substituted alkyl from 7 to 19 carbons, O-sulfate ester, O-phosphate ester or hydrogen,

sp is acyl from 1 to 8 carbons, O-sulfate ester, O-phosphate ester or hydrogen,

Z is acyl from 1 to 8 carbons, phenyl substituted alkyl from 7 to 19 carbons, O-sulfate ester, O-phosphate ester or hydrogen,

M is hydrogen or alkyl from 1 to 3 carbons, and

N is an azide group.

E1

90. The synthetic pure compound of claim 89 wherein

T is acetyl, monochloroacetyl, trichloroacetyl, benzyl, paramethoxybenzyl, or hydrogen,

X is O-acetyl, O-methyl, O-benzyl, bromide or imidoyl,

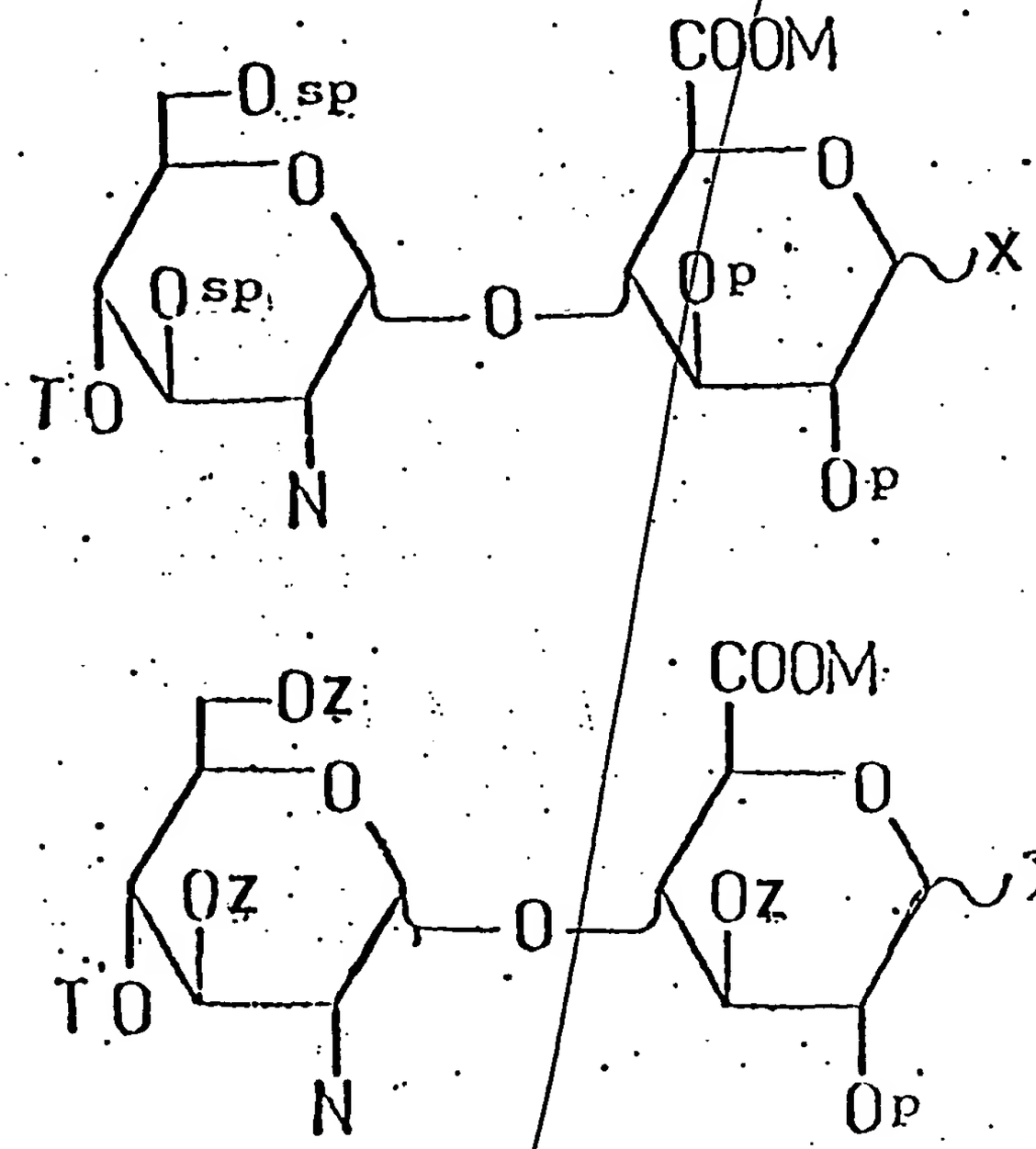
p is benzyl,

sp is acetyl, sulfate ester, phosphate ester or hydrogen,

Z is benzyl, acetyl or hydrogen, and

M is hydrogen or methyl

91. An synthetic pure compound of the formula selected from the group consisting of



(VI)

(VII)

wherein

T is acyl from 1 to 8 carbons, halogenated acyl from 1 to 8 carbons, phenyl substituted alkyl from 7 to 19 carbons, O-sulfate ester, O-phosphate ester or hydrogen,

X is O-acyl from 1 to 8 carbons, O-alkyl from 1 to 3 carbons, O-phenyl substituted alkyl from 7 to 19 carbons, halogen, imidoyl or hydrogen,

p is phenyl substituted alkyl from 7 to 19 carbons or hydrogen,

sp is acyl from 1 to 8 carbons or hydrogen,

Z is acyl from 1 to 8 carbons, phenyl substituted alkyl from 7 to 19 carbons or hydrogen,

M is alkyl from 1 to 3 carbons or hydrogen, and

N is azide or acyl-substituted amine.

92. The synthetic pure compound of claim 91 wherein

T is acetyl, monochloroacetyl, trichloroacetyl, benzyl paramethoxybenzyl, or hydrogen,

X is O-acetyl, O-methyl, O-benzyl, bromide, imidoyl, O-propenyl, O-allyl or OH,

p is benzyl,

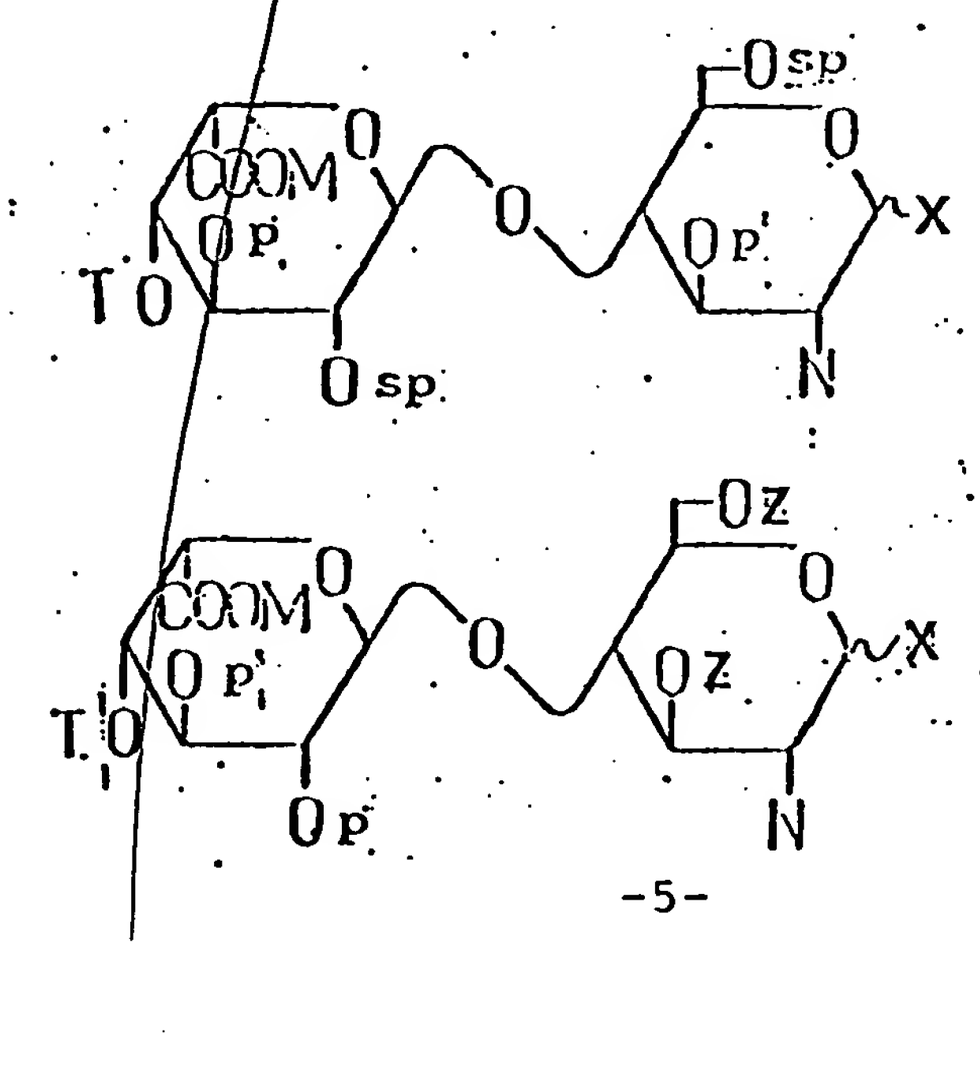
sp is benzyl, acetyl, sulfate ester, phosphate ester or hydrogen,

Z is benzyl, acetyl or hyrogen,

M is hydrogen or methyl, and

N is azide or NH-acetyl.

93. A synthetic pure compound of the formula selected from the group consisting of



(IX)

(X)

wherein

T is acyl from 1 to 8 carbons, halogenated acyl from 1 to 8 carbons, phenyl substituted alkyl from 7 to 19 carbons or hydrogen

X is O-acyl from 1 to 8 carbons, O-alkyl from 1 to 3 carbons, O-phenyl substituted alkyl from 7 to 19 carbons, halogen or imidoyl,

sp is acyl from 1 to 8 carbons, phenyl substituted alkyl from 7 to 19 carbons or hydrogen,

p is acyl from 1 to 8 carbons, phenyl substituted alkyl from 7 to 19 carbons or hydrogen,

Z is acyl from 1 to 8 carbons, phenyl substituted alkyl from 7 to 19 carbons or hydrogen,

M is hydrogen or alkyl from 1 to 3 carbons,

N is azide or NHCOO-(phenyl substituted alkyl).

94. The synthetic pure compound of claim 93 wherein

T is acetyl , monochloroacetyl, trichloroacetyl, benzyl, paramethoxybenzyl or hydrogen,

X is O-acetyl, O-methyl, O-benzyl, bromide or imidoyl,

p is acetyl, benzoyl or benzyl,

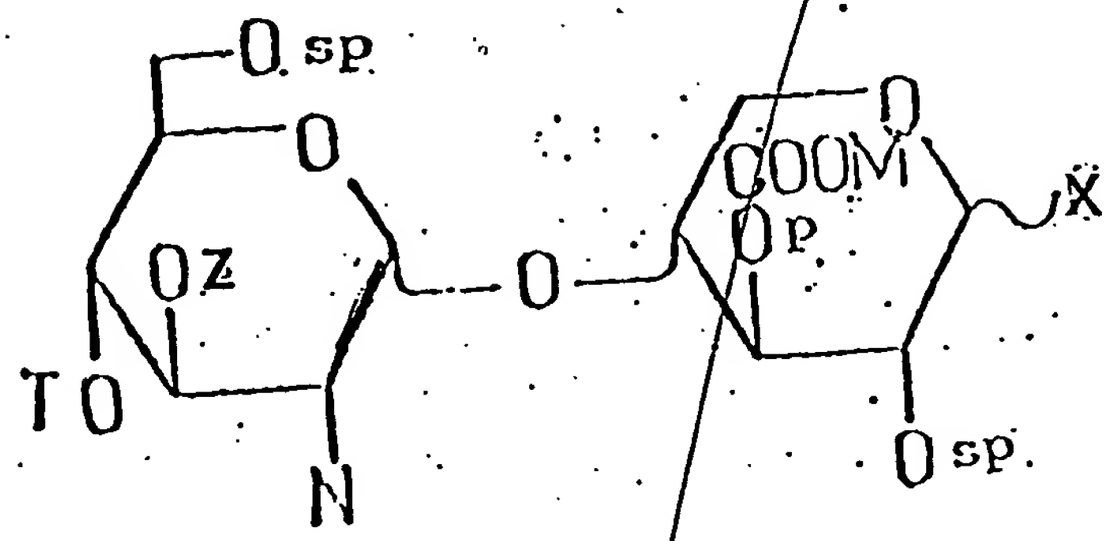
sp is acetyl, sulfate ester, phosphate ester, benzoyl or benzyl,

Z is acetyl, benzoyl or benzyl,

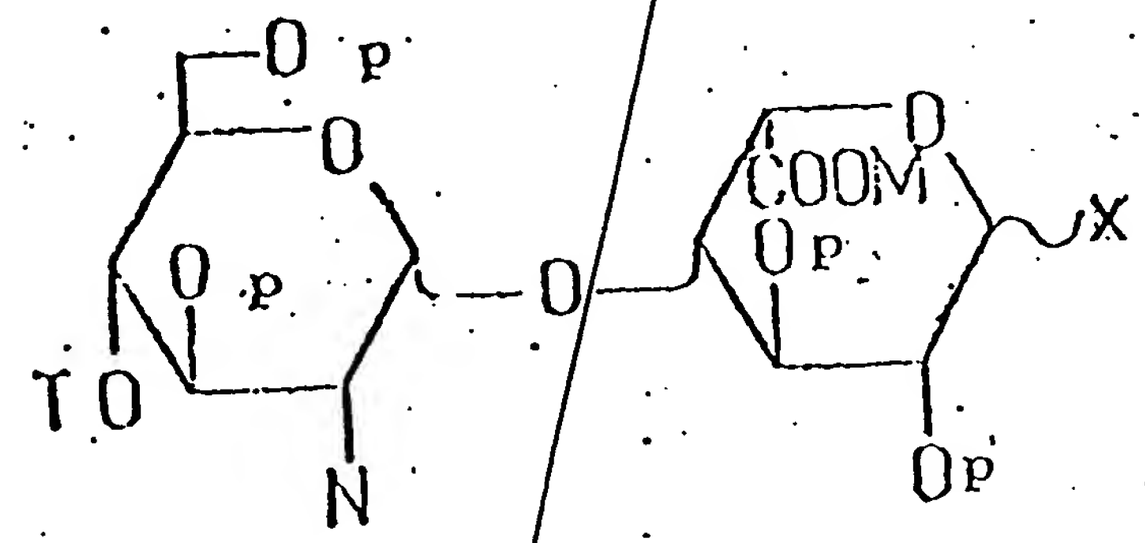
M is hydrogen or methyl, and

N is azide, $NHCOOCH_2C_6H_5$.

95. A synthetic pure compound of the formula



(XII)



(XIII)

wherein

T is acyl, halogenated acyl from 1 to 8 carbons, phenyl substituted alkyl from 7 to 19 carbons or hydrogen,

X is O-acyl from 1 to 8 carbons, O-alkyl from 1 to 3 carbons, O-phenyl substituted alkyl from 6 to 7 carbons, halogen or imidoyl,

p is phenyl substituted alkyl from 7 to 19 carbons or hydrogen,

sp is acyl from 1 to 8 carbons or hydrogen,

Z is acyl from 1 to 8 carbons, phenyl substituted alkyl from 7 to 19 carbons or hydrogen,

M is hydrogen or alkyl from 1 to 3 carbons, and

N is azide.

96. The synthetic pure compound of claim 95 wherein

T is acetyl, monochloroacetyl, trichloroacetyl, benzyl, paramethoxybenzyl, or hydrogen

X is O-acetyl, O-methyl, O-benzyl, bromide or imidoyl,

p is benzyl,

sp is acetyl, sulfate ester, phosphate ester or hydrogen,

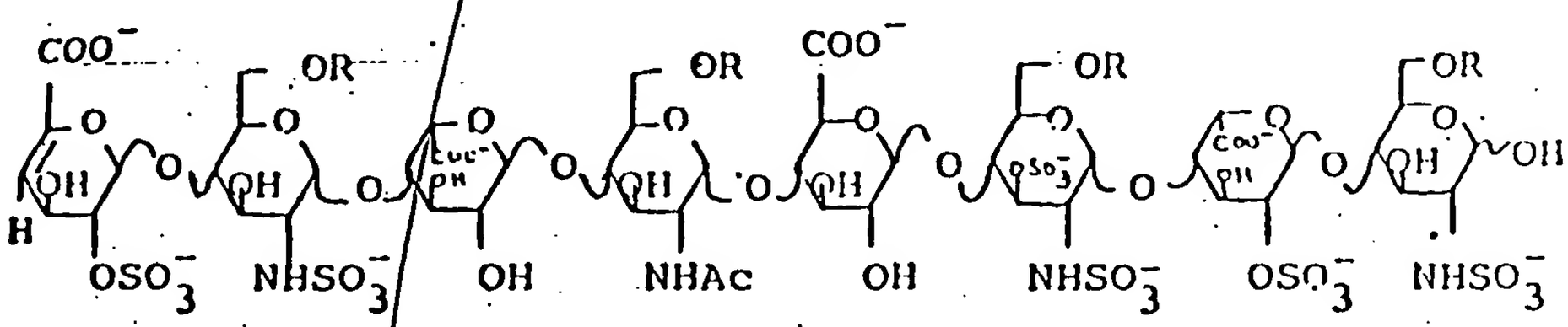
Z is benzyl, acetyl or hydrogen, and

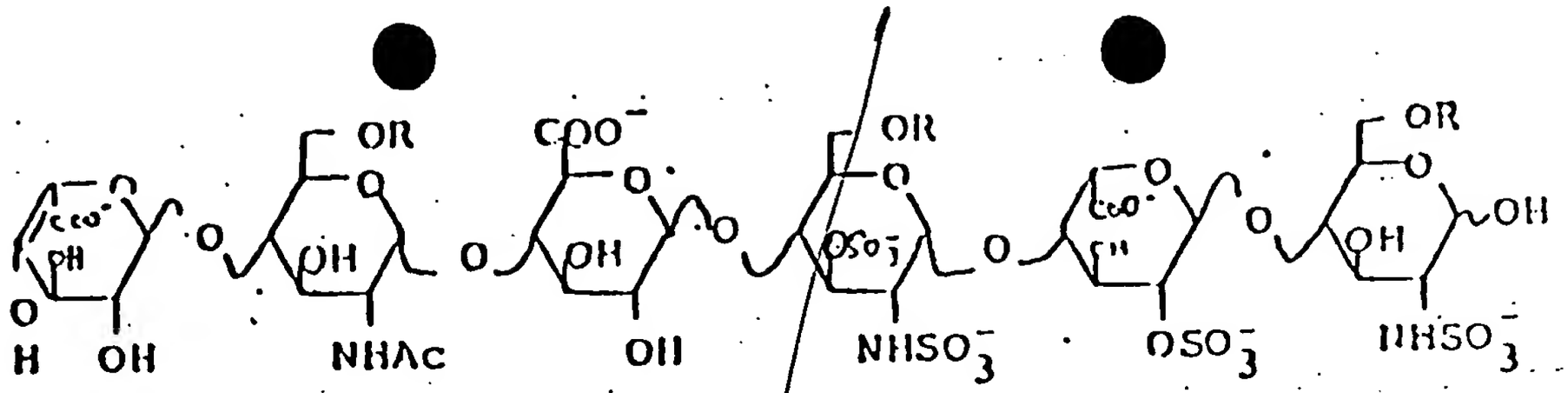
M is hydrogen or methyl.

E1

97. A synthetic pure compound having the structure selected from the group consisting of

ABCDEFG, C'DEFGH, AB, BC, CD, DE, EF, FG, GH, ABC, BCD, CDE, DEF, EFG, EFGN, FGH, ABCD, BCDE, CDEF, DEFG, EFGH, ABCDE, BCDEF, CDEFG, DEFGH, ABCDEF, BCDEFG, CDEFGH, or BCDEFGH wherein the letters A, B, C, C', D, E, F, G and H correspond to the structures of the formulas

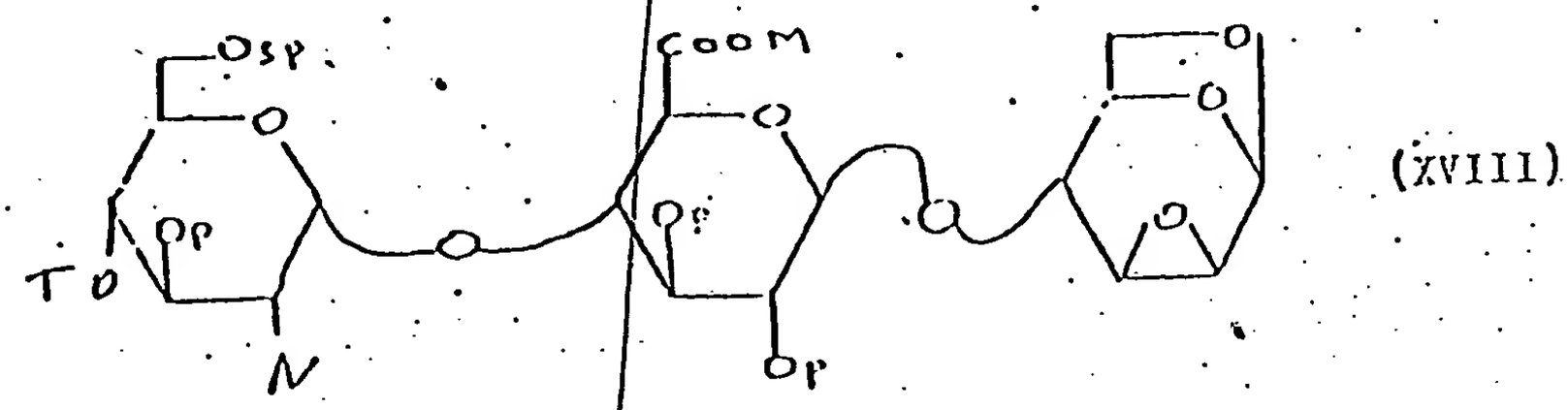




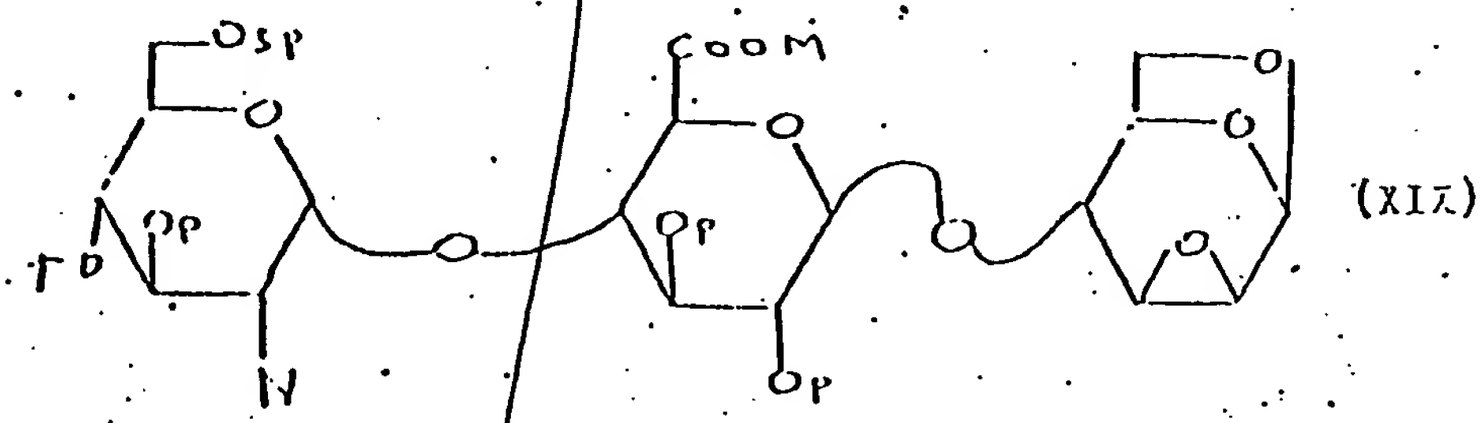
C' D E F G H

wherein R is hydrogen or $-SO_3^-$.

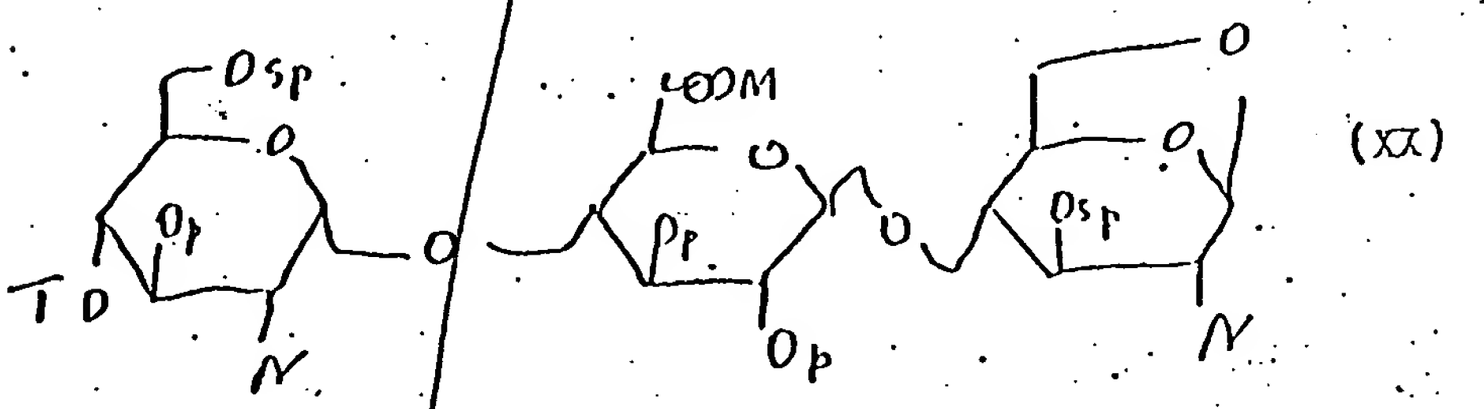
98. The synthetic pure compound having the formula selected from the group consisting of



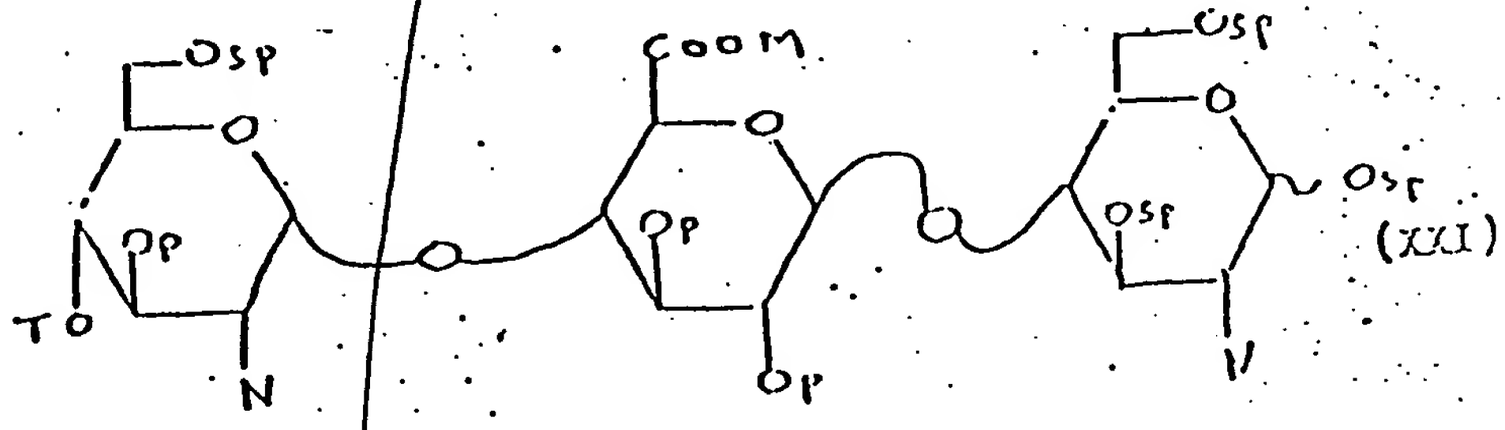
(XVIII)



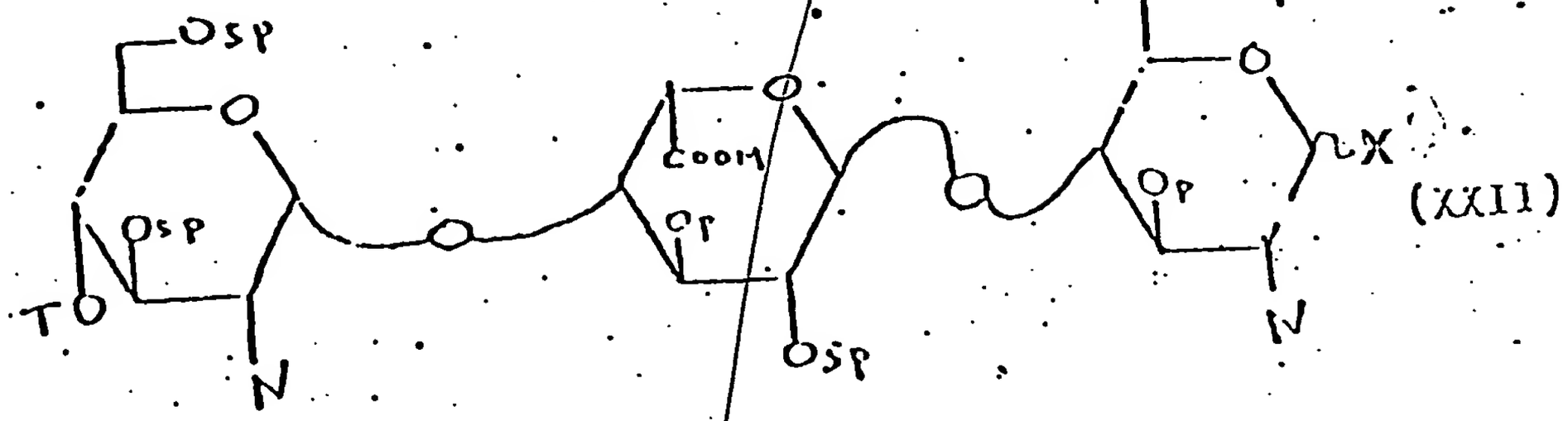
(XIX)



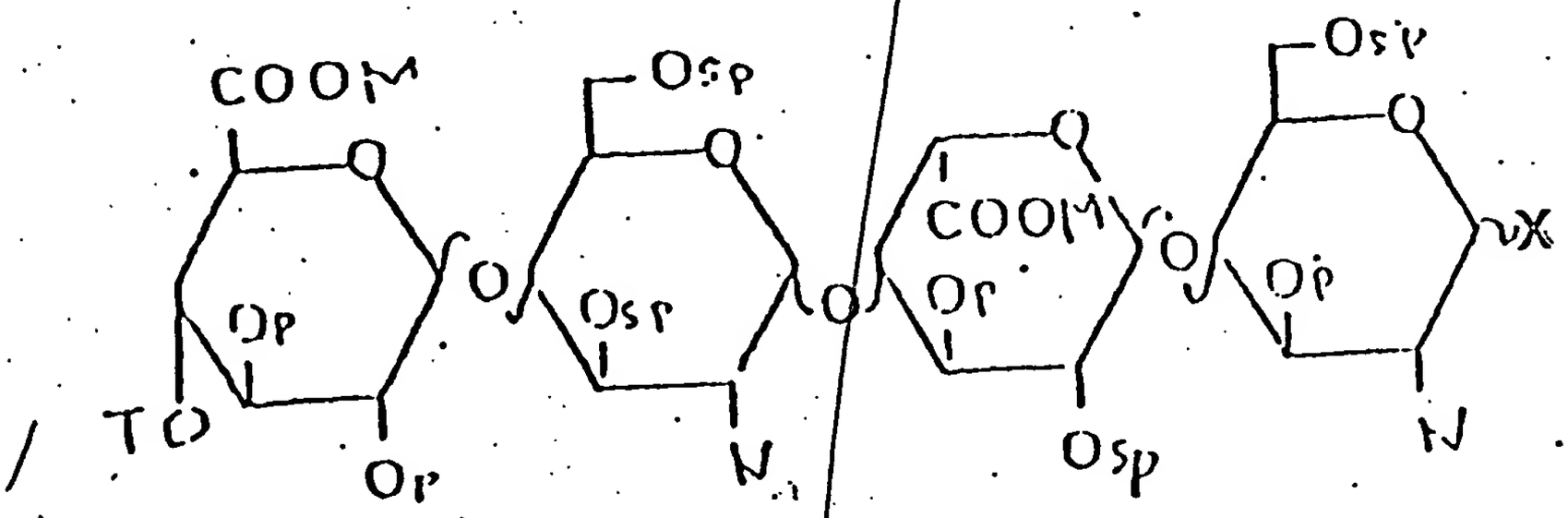
(XX)



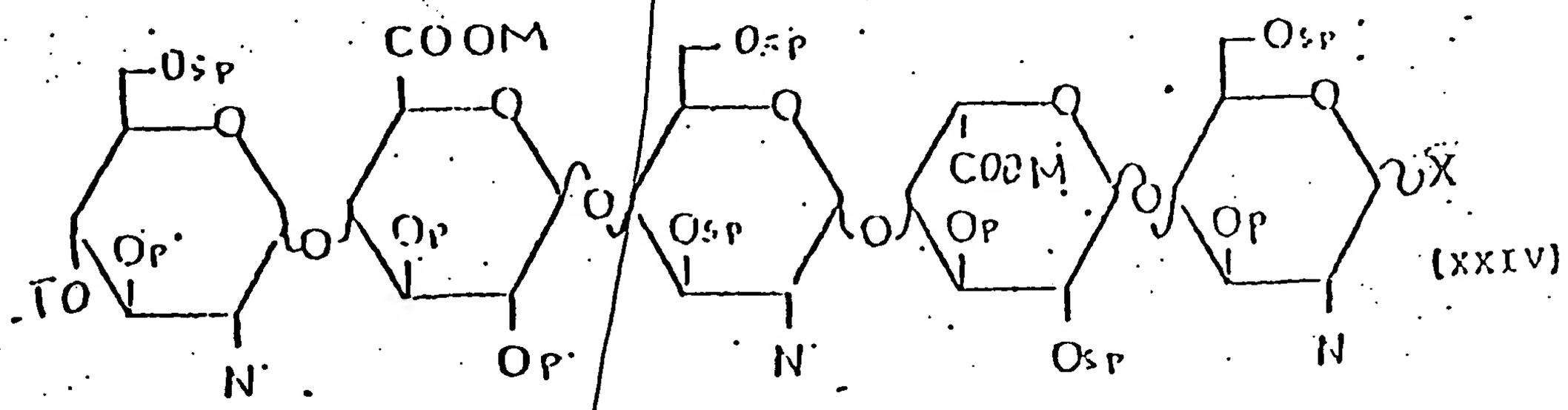
(XXI)



(XXII)



(XXIII)



(XXIV)

wherein

T is acyl from 1 to 8 carbons, halogenated acyl from 1 to 8 carbons, phenyl substituted alkyl from 7 to 19 carbons or hydrogen,

X is O-acyl from 1 to 8 carbons, O-alkyl from 1 to 3 carbons, O-phenyl substituted alkyl from 7 to 19 carbons, halogen or imidoyl,

p is phenyl substituted alkyl from 7 to 19 carbons or hydrogen,

sp is acyl from 1 to 8 carbons or hydrogen,

M is alkyl or hydrogen, and

N is azide, or phenyl substituted amino.

99. The synthetic pure compound of claim 98 wherein

T is acetyl, monochloroacetyl, trichloroacetyl, benzyl, paramethoxybenzyl or hydrogen,

X is O-acetyl, O-methyl, O-allyl, O-propenyl, O-benzyl, bromide or imidoyl,

p is benzyl or hydrogen,

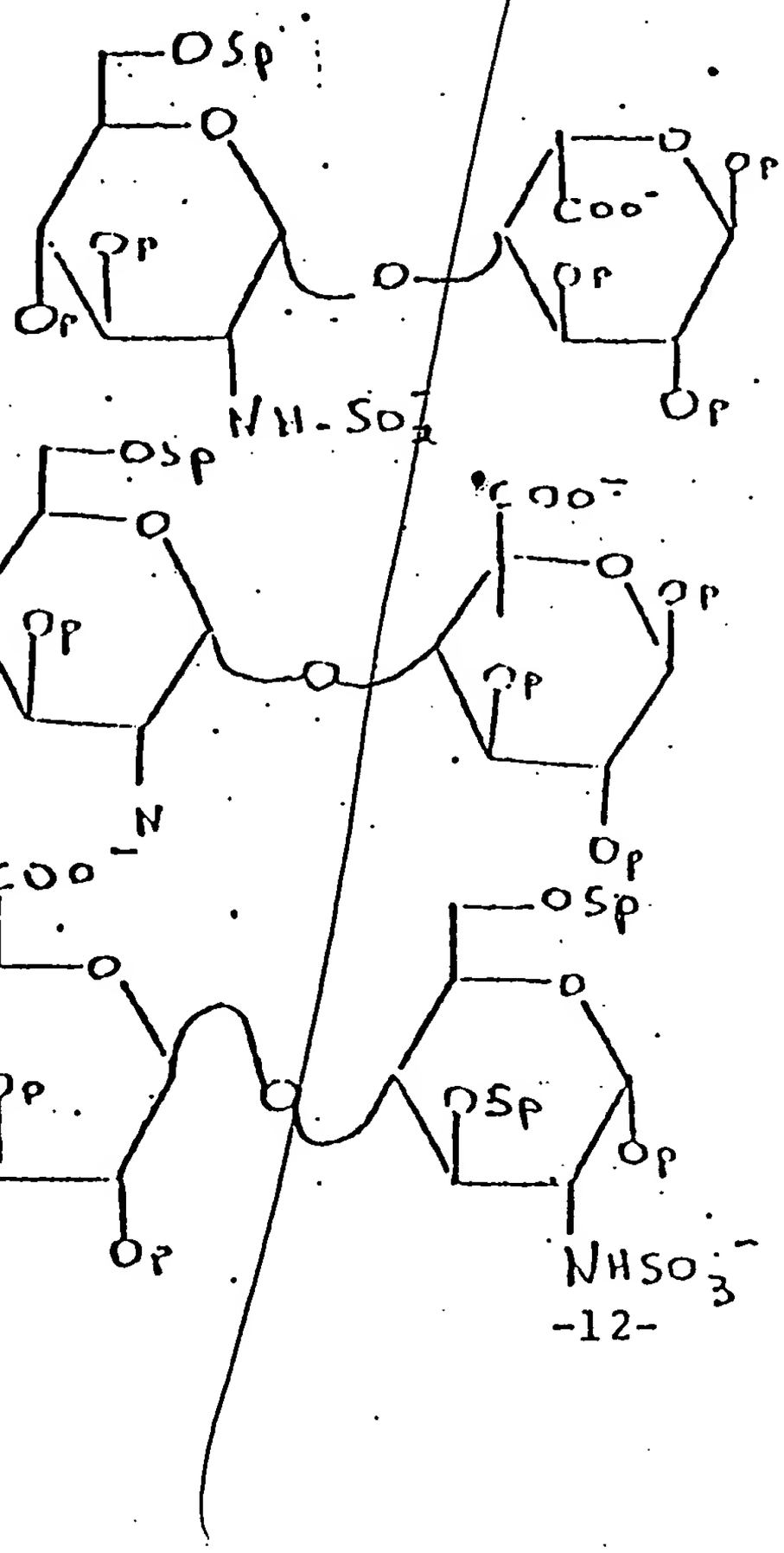
sp is acetyl, sulfate ester, phosphate ester or hydrogen,

M is hydrogen or methyl, and

N is azide, NH acetyl, NHCOO-acetyl or $NHCOOCH_2C_6H_5$.

100. The synthetic pure compound of claim 90, 92, 94 or 96 wherein sp is sulfate ester or phosphate ester and N is NH-acetyl or $NHSO_3$.

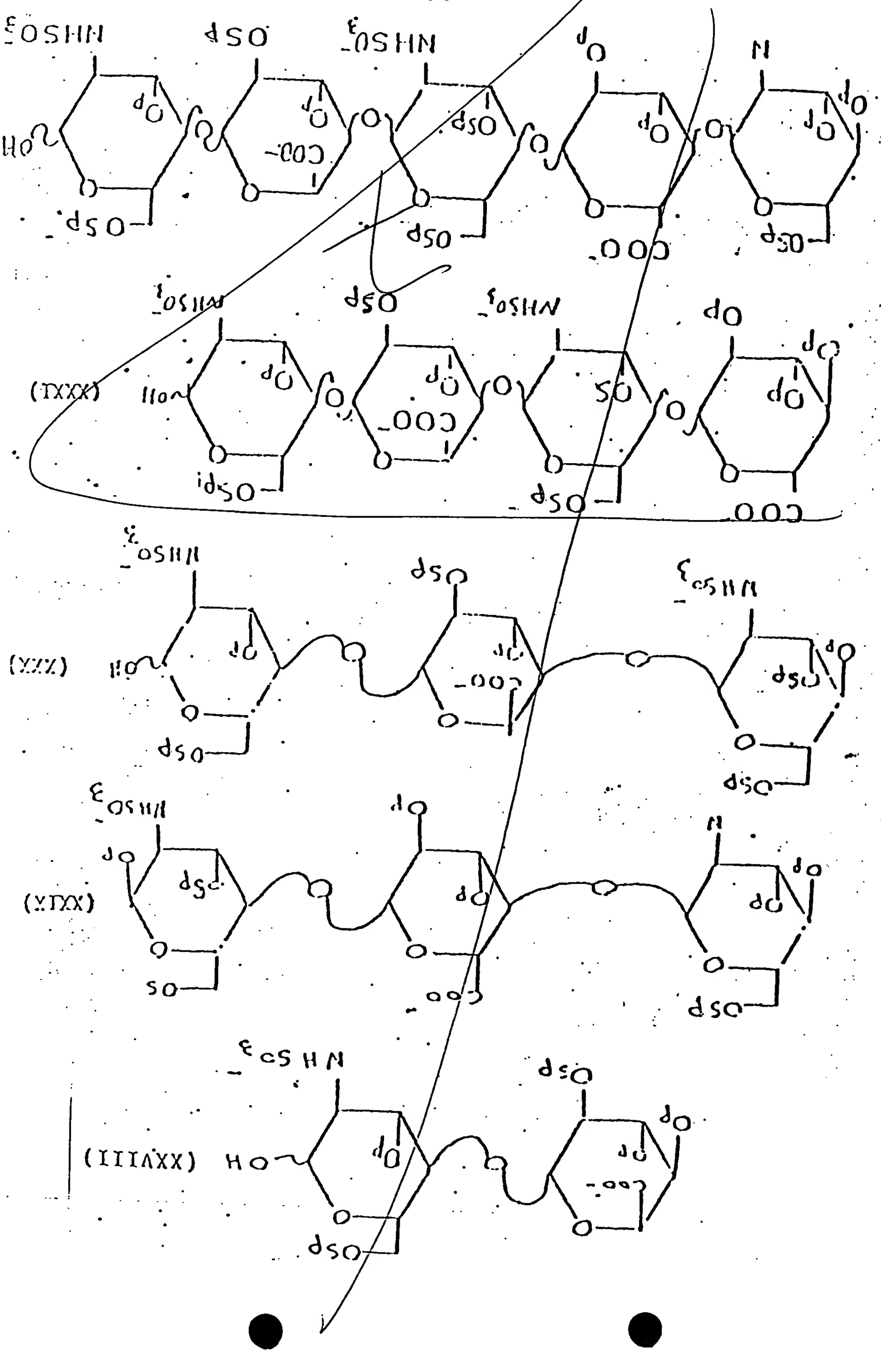
101. A synthetic pure compound of the formula selected from the group consisting of

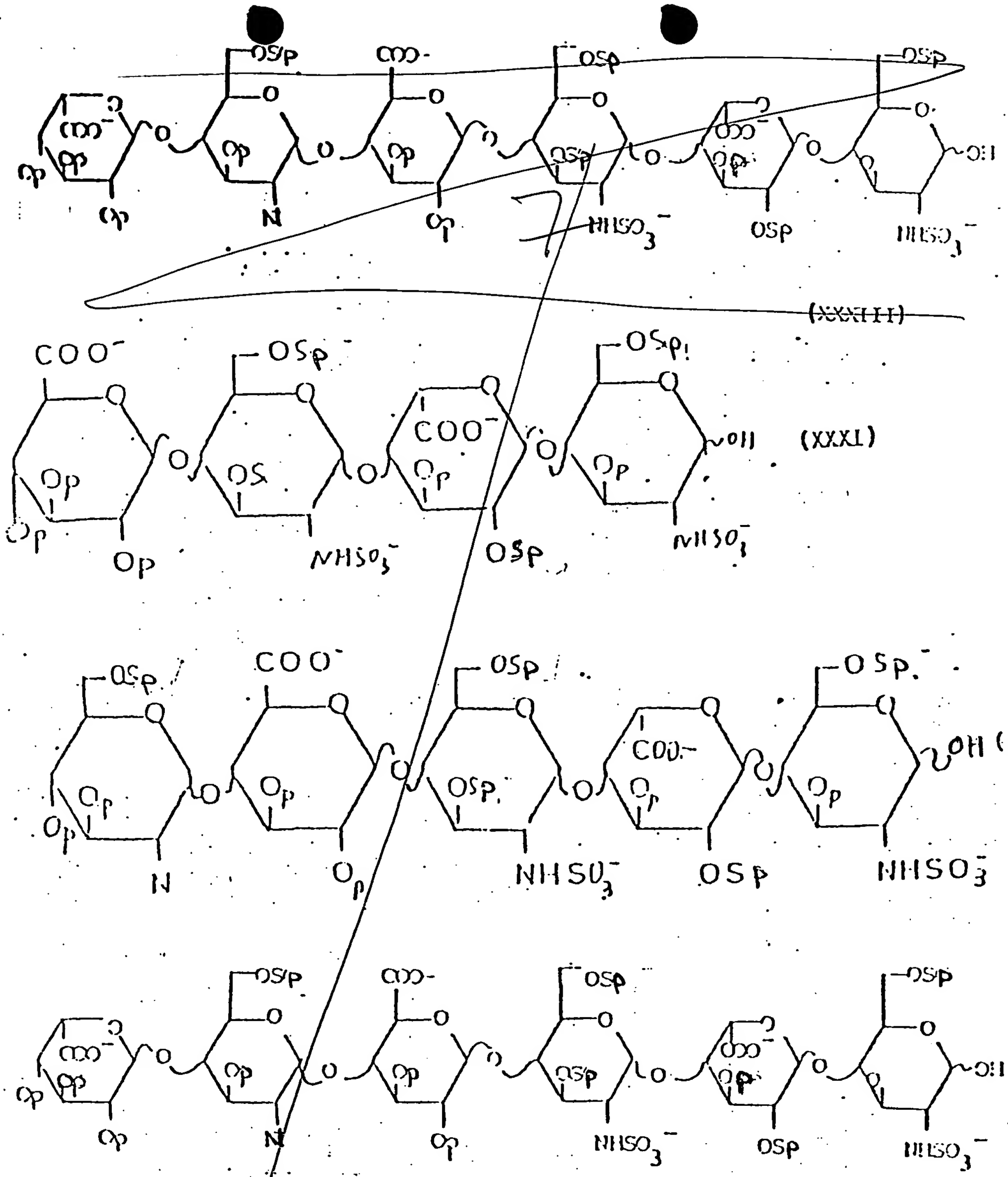


(XXV)

(XXVI)

(XXVII)





(XXXII)

(XXXIII)

wherein N is NH-acyl or $NHSO_3^-$,

p is benzyl or hydrogen,

sp is SO_3^- or H, and its pharmaceutically acceptable salts.

102. The synthetic pure compound of claim 101 wherein p is hydrogen.

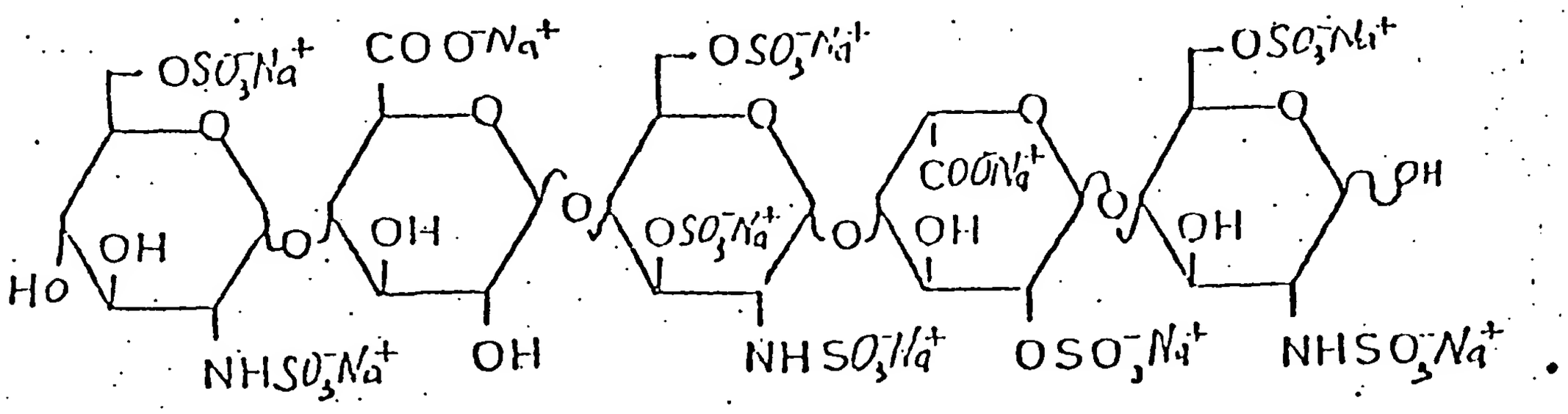
103. The synthetic pure compound of claim 101 wherein sp is SO_3^-.

104. The synthetic pure compound of claim ~~1014~~ 101 wherein sp is SO_3^- and p is H.

105. The synthetic pure compound of claims 82, 91, 93, 95 wherein at least one

p, sp, Z, or T is H, O-sulfate ester or O-phosphate ester with the exclusion of 2-N-sulfate-6-O-sulfate-D-glucosamine -methyl-D-glucuronic acid or 2-N-acetyl-6-O-sulfate-D-glucosamine-methyl-D-glucuronic acid.

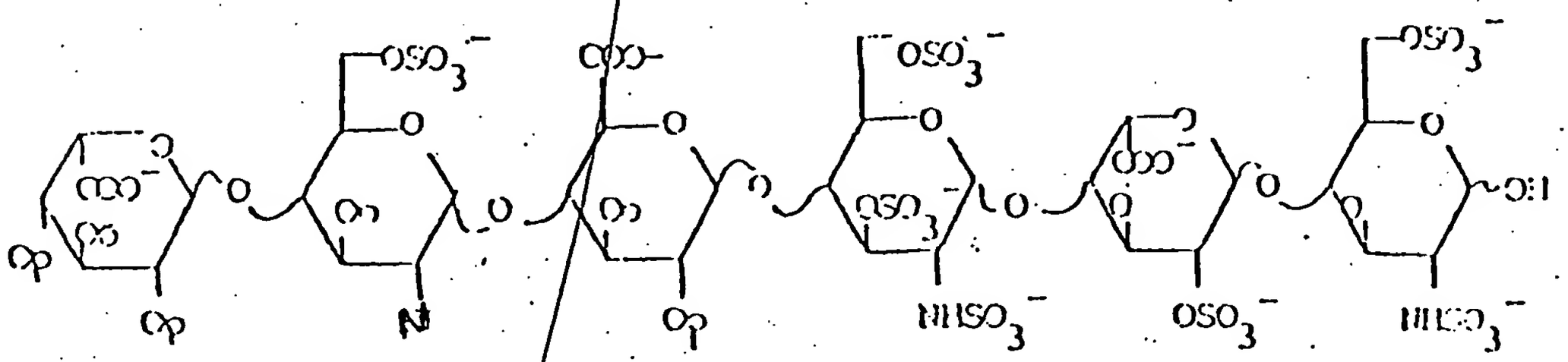
~~106~~ 60. A synthetic pure compound of the formula



~~101~~ 61. An antithrombotic pharmaceutical composition which comprises a pharmaceutically acceptable carrier and the compound of claim ~~100~~ 60.

~~108~~. An antithrombotic pharmaceutical composition which comprises a pharmaceutically acceptable carrier and the compound of claim 101.

109. The pharmaceutical composition of claim 108 wherein the compound has the formula



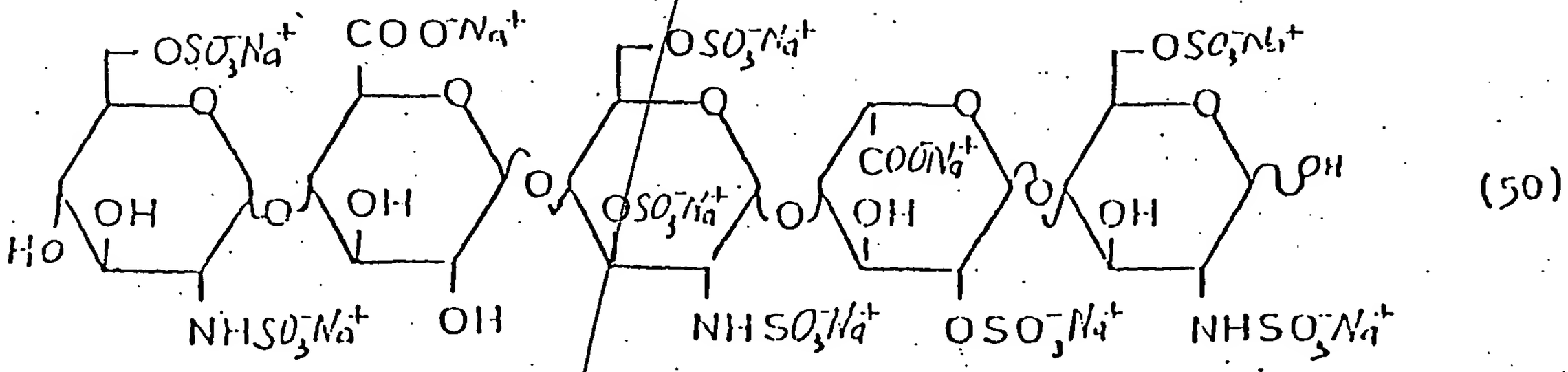
(XXXIII)

wherein

N is $NHSO_3^-$ or NH-acyl and

p is hydrogen.

110. The pharmaceutical composition of claim 108 wherein the compound has the formula



(50)

111. A therapeutic method of controlling thrombosis which comprises administering to a patient in a therapeutically effective amount the pharmaceutical composition of claim 107.

112. A therapeutic method of controlling thrombosis which comprises administering to a patient in a therapeutically effective amount the pharmaceutical composition of claim 108.

113. A therapeutic method of controlling thrombosis which comprises administering to a patient the pharmaceutical composition of claim 109.

114. A therapeutic method of controlling thrombosis which comprises administering to a patient the pharmaceutical composition of claim 110.

115. The method of claim 112 wherein the composition is administered intravenously.

116. The method of claim 112 wherein the composition is administered orally.

117. The method of claim 112 wherein the composition is administered subcutaneously.

118. The method of claim 112 wherein the composition is administered rectally.

119. A pharmaceutical composition for the prophylaxis and treatment of thrombosis which comprises a pharmaceutically acceptable carrier, the compound of claim 101 and a veinotonic or thrombolytic agent.

120. The composition of claim 119 wherein the veinotonic or thrombolytic agent is dihydroergotamine, nicotinic acid salt or urokinase.

121. A synthetic pure compound which comprises a chain of from 2 to 12 saccharides having the structure (A-U)n or (U-A)n wherein

n is 1 to 6,

A is a glucosamine or galactosamine and

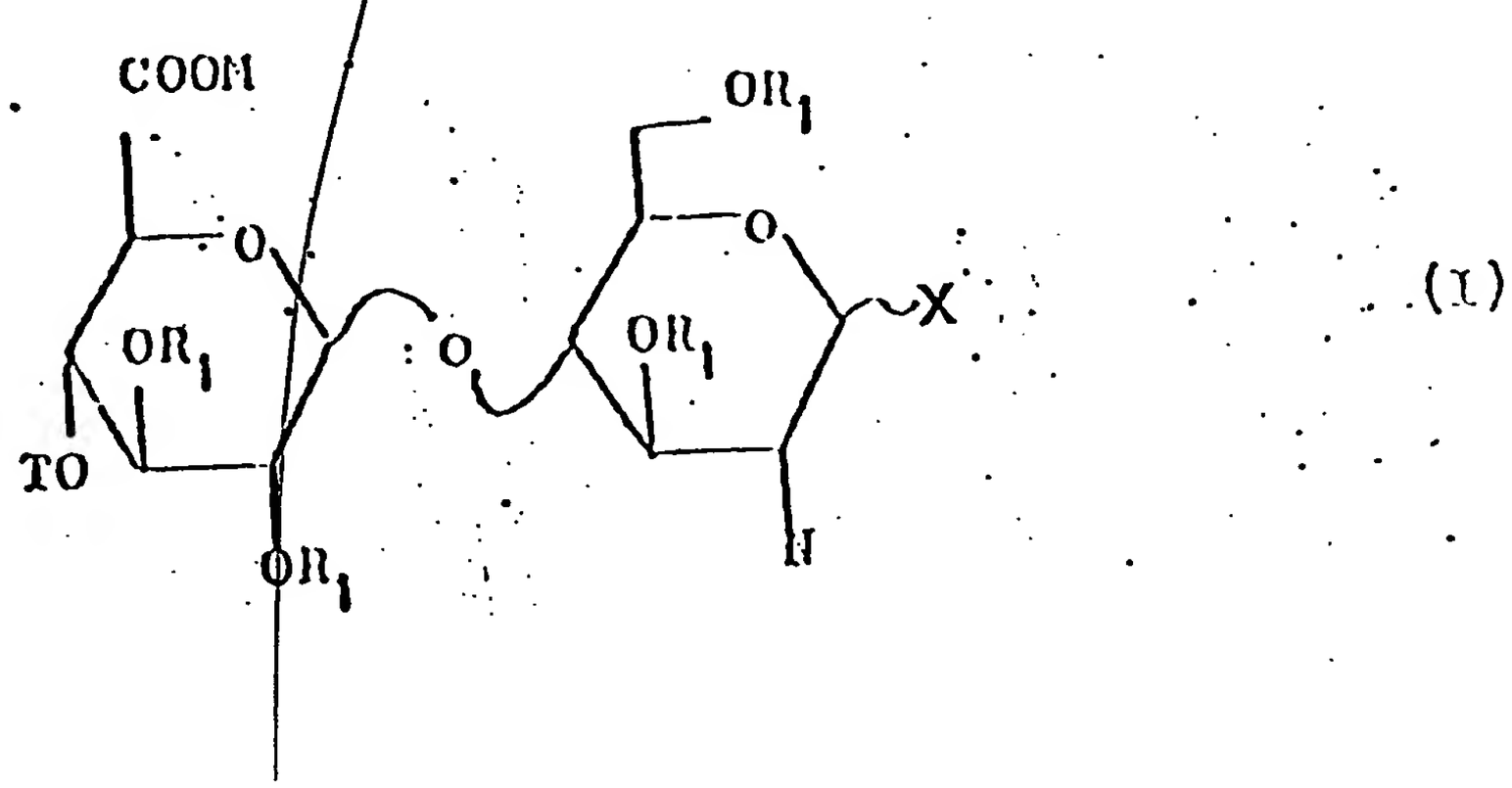
U is a glucuronic acid or iduronic acid wherein the saccharides are linked to the neighboring saccharide at the 1 and 4 position.

122. The synthetic pure compound of claim 121 having the structure of a heparin or heparin sulfate fragments which comprises,

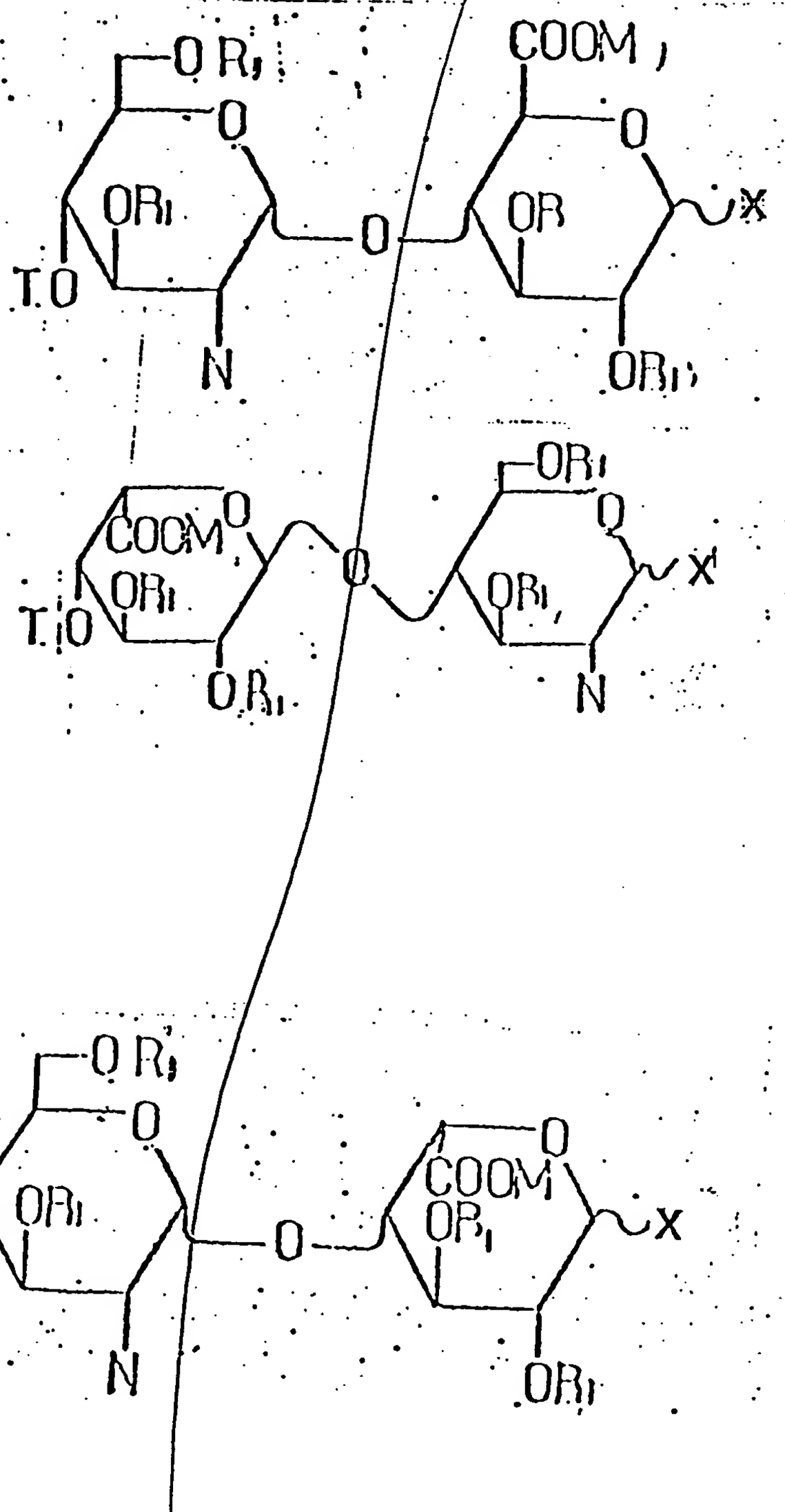
$\underline{c}1 \xrightarrow{\alpha} 4\underline{a}$, $\underline{a}1 \xrightarrow{\alpha} 4\underline{b}$, $\underline{a}1 \xrightarrow{\alpha} 4\underline{c}$ and

$\underline{b}1 \xrightarrow{\beta} 4\underline{a}$ linkage wherein a is D-glucosamine, b is D-glucuronic acid and c is L-iduronic acid.

123. A synthetic pure compound of the formula selected from the group consisting of



(I)



(V)

(VIII)

(XI)

wherein

T is hydrogen or a group which can be replaced by a saccharide,

X is OH or a group which can be replaced by a saccharide,

N is a radical containing a nitrogen group,

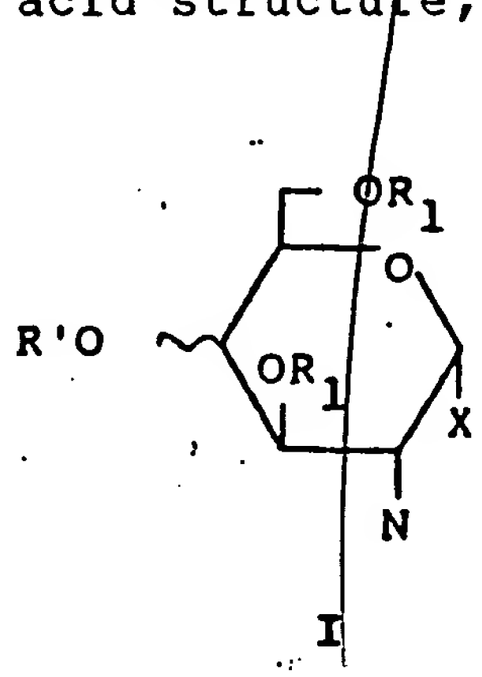
M is hydrogen, a sulfate group or a group which can be replaced by hydrogen, and

R_1 is the same or different and is hydrogen, acyl from 1 to 8 carbons, alkyl from 1 to 9 carbons or sulfate.

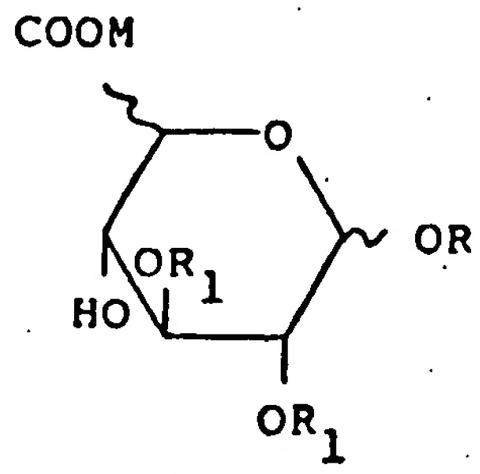
124. A process for the synthesis of oligosaccharides of the heparinic type, having D-glucosamine or uronic acid (D-glucuronic acid or L-iduronic acid) alternate moieties, or the reverse, comprising 2 to 12 of said moieties, which comprises:

condensing a D-glucosamine moiety (I) with an uronic acid moiety (II)

corressponding to a D-glucuronic acid or a L-iduronic acid structure, of formulae:

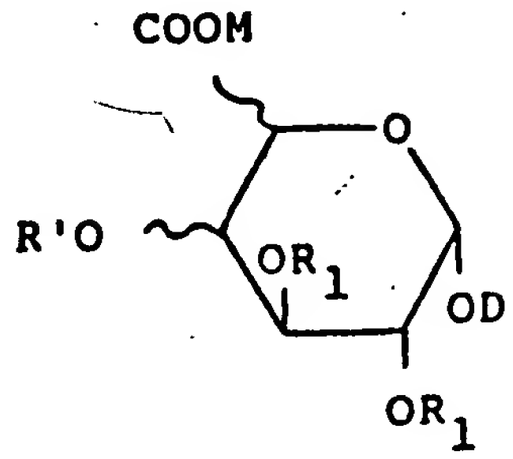


I

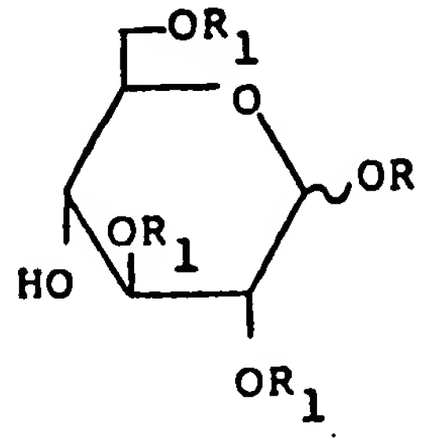


II

or, an uronic acid moiety (III) with a D-glucosamine moiety (IV), having formulae:



III



IV

wherein:

the anomeric carbon is substituted by a reactive group X or OD, capable of reacting with the -OH group at the position 4 of (II) to give a linkage between a D-glucosamine and a D-glucuronic or an L-iduronic acid, and between an L-iduronic acid and a D-glucosamine, or a linkage with a stereospecificity, between a D-glucuronic acid and a glucosamine, said X being an halogen and said -OD being an -O-imidoyl group or, together with the adjacent $-OR_1$ group, forming an orthoester,

the R_1 groups represent -OH protecting groups, at least one of the R_1 groups being different from the others, said groups being selected from an acyl, an alkyl, a substituted alkyl or an aryl radical, or for two R_1 groups next to each other, a cetal or an acetal group, or R_1 and R together form a 1,6-anhydro bridge and/or two $-OR_1$ groups in the glucosamines of formula IV form an epoxy function,

N is N_3 or NHCOO-acyl or benzyl group,

M is an alkyl or an aryl group,

R and R', identical or different, are selected from said R_1 meanings, a mono or an oligosaccharidic moiety with D-glucosamine or uronic acid units as given above, whose anomeric carbon in the case of R, of position 4 in the case of R' are blocked by a group -OT removable in the presence of the other groups present on the units of the starting products to recreate an alcohol, T being selected from an allyl, a propenyl, an acyl, an halogenated acyl or a p-methoxybenzoyl group with the proviso that R+R' 10 saccharidic moieties,

said T meanings, or

-Or is a symbol representing a reactive group-X or -OD,

sequentially removing the R_1 groups, first to introduce functional groups or specific positions as encountered in heparin, second to make free -OH groups on other specific positions, which simultaneously result in converting $-N_3$ or -NH-COO acyl or benzy into $-NH_2$, introducing a functional group on the amino radical, and removing M, with the proviso that the condensation reaction does not lead to the production of a disaccharide with a 2-N-sulphate or (2-N-acetyl)-6-O-sulphate-D-glucosamine-methyl-D-glucuronic acid structure.